

Preparing Activity: LANTNAVFACENGCOM

UNIFIED FACILITIES GUIDE SPECIFICATIONS

Use for LANTNAVFACENGCOM projects only

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SECTION 15951N

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08/00

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SECTION 15951N

INDUSTRIAL VENTILATION TEST/ADJUST/BALANCE  
08/00

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NOTE: This guide specification covers testing, adjusting and balancing (TAB) of industrial ventilation (INDVENT) systems. An industrial ventilation system is the mechanical equipment that provides the simultaneous exhaust and replacement of air to control contaminants generated from industrial operations. Test the following industrial ventilation system applications according to this specification:

NOTE: Suggestions for improvement of this specification will be welcomed using the Navy "Change Request Forms" subdirectory located in SPECSINTACT in Jobs or Masters under "Forms/Documents" directory or DD Form 1426. Suggestions should be forwarded to:

Commander  
Naval Facilities Engineering Command  
Engineering Innovation and Criteria Office, Code EICO  
1510 Gilbert Street  
Norfolk, VA 23511-2699

Email: LantDiv@efdlant.navfac.navy.mil

Use of electronic communication is encouraged.

Brackets are used in the text to indicate designer choices or locations where text must be supplied by the designer.

1. Systems installed to control employee exposure to:
  - a. Hazardous airborne materials with a Permissible Exposure Limit (PEL) or Threshold Limit Value (TLV) of 0.1 milligram per cubic meter or the equivalent value in parts per million.
  - b. Isocyanate paints.
  - c. Lead.
  - d. Beryllium.
  - e. Otto Fuel II.
2. Permanently installed asbestos delagging facilities.
3. Metal cleaning or electroplating shops.
4. Foundries.
5. Fiberglass layup and sprayup operations.
6. Abrasive blasting operations.
7. Carpentry shops.
8. Advanced composite operations (e.g., graphite).
9. Indoor Firing Ranges.

Include this specification with the construction project and require the Contractor to hire an independent subcontractor. This specification encourages the use of the Commissioning Process. Modify this specification for an acceptance or performance test contract for any industrial ventilation system.

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PART 1 GENERAL

## 1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by the basic designation only.

### ASSOCIATED AIR BALANCE COUNCIL (AABC)

AABC MN-1 (1989) Testing and Balancing Heating, Ventilating and Air Conditioning Systems

AABC TBP (1997) Test and Balance Procedures

### AMERICAN CONFERENCE OF GOVERNMENTAL INDUSTRIAL HYGIENISTS (ACGIH)

ACGIH 2090 (1995) Industrial Ventilation

### AMERICAN NATIONAL STANDARDS INSTITUTE (ANSI)

ANSI S1.4 (ASA 47) (1983; R 1994) Sound Level Meters

ANSI S1.11 (ASA 65) (1986; R 1993) Octave- Band and Fractional-Octave-Band Analog and Digital Filters

### AMERICAN SOCIETY OF HEATING, REFRIGERATING, AND AIR-CONDITIONING ENGINEERS, INC. (ASHRAE)

ASHRAE HA (1995) Handbook, HVAC Applications (Including Additions and Corrections for 1995, 1996)

### NATIONAL ENVIRONMENTAL BALANCING BUREAU (NEBB)

NEBB MASV (1994) Measurements and Assessment of Sound and Vibration

NEBB TABES (1991) Testing, Adjusting, Balancing of Environmental Systems

### SHEET METAL & AIR CONDITIONING CONTRACTORS' NATIONAL ASSOCIATION, INC. (SMACNA)

SMACNA HVACTAB (1993) HVAC Systems Testing, Adjusting and Balancing

## 1.2 RELATED REQUIREMENTS

Perform work required by this section in accordance with the paragraph entitled "Subcontractor Special Requirements" in Section 01310N, "Administrative Requirements."

Requirements for price breakdown of INDVENT TAB work are specified in Section 01200N, "Price and Payment Procedures."

Requirements for construction scheduling related to INDVENT TAB work are specified in [Section 01320N, "Construction Progress Documentation"] [Section 01321N, "Network Analysis Schedules"].

[Requirements for duct air leakage testing (DALT) related to INDVENT TAB work are specified in Section 15950N, "HVAC Testing, Adjusting and Balancing".]

### 1.3 DESCRIPTION OF WORK

The work includes test, adjust, and balance (TAB) of [new][new and existing] industrial ventilation (INDVENT) air distribution systems including equipment, and ducts which are located within, on, under, between, and adjacent to buildings.

#### 1.3.1 Insulation

Obtain Contracting Officer's written approval before applying insulation to exterior of air distribution systems under Section 15080N, "Mechanical Insulation."

### 1.4 DEFINITIONS

- a. Sound measurements terminology: Defined in AABC MN-1 or NEBB MASV.
- b. TAB team supervisor: TAB team engineer.
- c. TAB team technician: TAB team assistant.
- d. TAB'd: INDVENT Testing/Adjusting/Balancing procedures performed.
- e. DALT'd: INDVENT duct air leakage testing procedures performed.
- f. Field check group: One or more systems of the same basic type; the subgroup of a "field check group" is a "system."
- g. Out-of-tolerance data: Pertains only to field checking of certified TAB report. The term is defined as a measurement taken during field checking which does not fall within the range of plus 5 to minus 5 percent of the original measurement reported on the certified TAB report for a specific parameter.
- h. Capture velocity: Air velocity at any point in front of the hood or at the hood opening necessary to overcome opposing air currents and to capture contaminated air at that point to cause it to flow into the hood.
- i. Capture zone: Controlled space around an industrial process that provides a safe and healthy workspace.
- j. Equilibrium performance point: The operating condition after sufficient start-up time that an air pollution control device reaches optimum efficiency. The manufacturer recommends the minimum start-up time for each device.
- k. Facility: A building or portion of a building in which contaminated air is controlled by the industrial ventilation system. This includes the shop space, equipment room, offices, restrooms and locker rooms affected by the industrial process.
- l. Full load condition: Condition in the facility where exhaust and replacement air systems operate simultaneously, as installed by the Contractor according to the design plans and specifications.

- m. Heating and cooling equipment: Equipment used to temper air in the facility. Equipment includes, but is not limited to: condensers, chillers, pumps, heat exchangers, heating and cooling coils, heat pumps, cooling towers, and duct heaters.
- n. Hood static pressure: Static pressure, in Pascals (Pa) inches of water gage (wg), taken at 3 duct diameters from a flanged or plain hood or 1 duct diameter from a tapered hood.
- o. Manometer: An instrument for measuring pressure. Electronic or U-tube manometers with water or light oil are acceptable.
- p. Replacement air system: The mechanical system supplying air to a facility to replace exhausted air.
- q. Standard Temperature and Pressure: Air at standard conditions of 21.1 degrees Celcius and 101.3 kilopascals 70 degrees Fahrenheit and 1 atmosphere.
- r. Static Pressure: The potential pressure exerted in all directions by a fluid at rest. For a fluid in motion, it is measured in a direction normal to the direction of flow. Usually expressed in Pa inches of wg.
- s. System Effect: The estimated loss in fan performance from non-uniform air flow at the fan's inlet or outlet.
- t. Transport velocity: Minimum air velocity, in meter per second (m/s) feet per minute (fpm), required to prevent contaminants from settling, condensing, or pocketing in the ductwork.
- u. Velocity pressure: The kinetic pressure in the direction of flow necessary to cause a fluid at rest to flow at a given velocity. Usually expressed in Pa inches of wg.

#### 1.5 SUBMITTALS

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NOTE: Where a "G" in submittal tags follows a submittal item, it indicates Government approval for that item. Add "G" in submittal tags following any added or existing submittal items deemed sufficiently critical, complex, or aesthetically significant to merit approval by the Government. Submittal items not designated with a "G" will be approved by the QC organization.

For LANTNAVFACENGCOM jobs, keep "G" for submittals.

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Submit the following in accordance with Section 01330, "Submittal Procedures."

SD-06 Test Reports

Certified TAB report G

SD-07 Certificates

Independent TAB agency personnel qualifications G

Design review report G

Pre-field TAB engineering report G

Advanced notice for TAB field work G

Pre-TAB check out list G

#### 1.6 INDVENT TAB Submittal and Work Schedule

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NOTE: The calendar day requirements specified should apply to many construction projects. However, the specifier, when preparing this paragraph for a specific contract shall review and modify this paragraph to suit the contract construction schedule. Season 1 may be the season of maximum heating load or maximum cooling load, depending upon construction schedule.

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Compliance with the following schedule is the Contractor's responsibility.

- a. Qualify TAB Personnel: Within [45] [\_\_\_\_\_] calendar days after date of contract award, submit TAB agency and personnel qualifications.
- [b. Pre-TAB Meeting: Within [30] [\_\_\_\_\_] calendar days after the date of approval of the TAB agency and personnel, meet with the Contracting Officer's TAB representative.]
- c. Design Review Report: Within [60] [\_\_\_\_\_] calendar days after the date of the TAB agency personnel qualifications approval, submit design review report.
- d. Pre-Field TAB Engineering Report: Within [\_\_\_\_\_] calendar days after approval of the TAB Agency Personnel Qualifications, submit the Pre-Field TAB Engineering Report.
- e. Pre-TAB Check Out List and Advanced Notice For TAB Field Work: At a minimum of [115] [\_\_\_\_\_] calendar days prior to CCD, submit [Season 1] prerequisite INDVENT work check out list certified as complete, and submit advance notice of commencement of TAB field work.
- f. TAB Field Work: At a minimum of [90] [\_\_\_\_\_] calendar days prior to CCD, accomplish TAB field work; submit certified TAB report; and conduct field check.
- g. Complete TAB Work: Prior to CCD, complete all TAB work.

#### 1.7 QUALITY ASSURANCE

##### 1.7.1 Modifications of References

Accomplish work in accordance with referenced publications of AABC or NEBB



except as modified by this section. In the references referred to herein, consider the advisory or recommended provisions to be mandatory, as though the word "shall" had been substituted for the words "should" or "could" or "may" wherever they appear. Interpret reference to the "authority having jurisdiction," the "Administrative Authority," the "Owner," or the "Design Engineer" to mean the "Contracting Officer."

## 1.7.2 Certificates

### 1.7.2.1 Independent TAB Agency Personnel Qualifications

For agency proposed for approval, submit information certifying that: The TAB agency is a first tier subcontractor who is not affiliated with any other company participating in work on this contract; the work to be perform by the TAB agency shall be limited to testing, adjusting, and balancing of INDVENT air systems to satisfy the requirements of this specification section.

Submit the following, for the agency, to Contracting Officer for approval in compliance with paragraph entitled "TAB Personnel Qualification Requirements."

a. Independent AABC or NEBB certified TAB agency:

(1) TAB agency: AABC registration number and expiration date of current certification; or NEBB certification number and expiration date of current certification.

(2) TAB team supervisor: Name and copy of AABC or NEBB TAB supervisor certificate and expiration date of current certification.

(3) TAB team field leader: Name and documented evidence that the team field leader meets the qualification requirements.

(4) TAB team field technicians: Names and documented evidence that each field technician meets the qualification requirements.

(5) Current certificates: Registrations and certifications shall be current, and valid for the duration of this contract. Certifications which expire prior to completion of the TAB work, shall be renewed in a timely manner so that there is no lapse in registration or certification. TAB agency or TAB team personnel without a current registration or current certification shall not perform TAB work on this contract.

b. Replacement of TAB team members: Replacement of members may occur if each new member complies with the applicable personnel qualifications and each is approved by the Contracting Officer.

### 1.7.2.2 Design Review Report

Submit typed report describing omissions and deficiencies in the INDVENT system's design that would preclude the TAB team from accomplishing the TAB work requirements of this section. Provide a complete explanation including supporting documentation detailing the design deficiency. State that no deficiencies are evident if that is the case.

#### 1.7.2.4 Pre-Field TAB Engineering Report

Submit report containing the following information:

- a. Step-by-step TAB procedure:
  - (1) Strategy: Describe the method of approach to the TAB field work from start to finish. Include in this description a complete methodology for accomplishing each seasonal TAB field work session.
  - (2) Procedural steps: Delineate fully the intended procedural steps to be taken by the TAB field team to accomplish the required TAB work of each air distribution system. Include intended procedural steps for TAB work for subsystems and system components.
- b. Pre-field data: Submit AABC or NEBB or SMACNA HVACTAB report forms with the following pre-field information filled in:
  - (1) Design data obtained from system drawings, specifications, and approved submittals.
  - (2) Notations detailing additional data to be obtained from the contract site by the TAB field team.
  - (3) Designate the actual data to be measured in the TAB field work.
  - (4) Provide a list of the types of instruments, and the measuring range of each, which are anticipated to be used for measuring in the TAB field work. By means of a keying scheme, specify on each TAB data report form submitted, which instruments will be used for measuring each item of TAB data. If the selection of which instrument to use, is to be made in the field, specify from which instruments the choice will be made. The instrument key number shall be placed in the blank space where the measured data would be entered.
- c. Prerequisite INDVENT work checkout list: Provide a list of inspections and work items which are to be completed by the Contractor. This list shall be acted upon and completed by the Contractor and then submitted and approved by the Contracting Officer prior to the TAB team coming to the contract site.
- d. At a minimum, a list of the applicable inspections and work items listed in the NEBB TABES, Section III, "Preliminary TAB Procedures" under paragraphs titled, "Air Distribution System Inspection" and "Hydronic Distribution System Inspection" shall be provided for each separate system to be TAB'd.

#### 1.7. TAB Personnel Qualification Requirements

##### 1.7.3.1 Independent AABC or NEBB Certified TAB Agency

Provide services of a TAB agency certified by AABC or NEBB to perform and manage TAB work on INDVENT air systems. This TAB agency shall not be affiliated with any company participating in any other phase of this contract, including design, furnishing equipment, or construction.

##### 1.7.3.2 TAB Team Personnel

The TAB team approved to accomplish work on this contract shall be full-time employees of the TAB agency. No other personnel shall do TAB work on this contract.

- a. TAB Team Supervisor: Supervisor shall be qualified by AABC or NEBB as a TAB supervisor or a TAB engineer.
- b. TAB Team Field Leader: Leader shall have satisfactorily performed full-time supervision of TAB work in the field for not less than 3 years immediately preceding this contract's bid opening date.
- c. TAB Team Field Technician: Technician shall have satisfactorily assisted a TAB team field leader in performance of TAB work in the field for not less than one year immediately preceding this contract's bid opening date.

#### 1.7.4 Responsibilities

The Contractor shall be responsible for ensuring compliance with the requirements of this section. The following delineation of specific work responsibilities is specified to facilitate execution of the various work efforts by personnel from separate organizations. This breakdown of specific duties is specified to facilitate adherence to the schedule listed in paragraph entitled "TAB Submittal and Work Schedule."

##### 1.7.4.1 Contractor

- a. TAB personnel: Ensure that the TAB work is accomplished by a group meeting the requirements specified in paragraph entitled "TAB Personnel Qualification Requirements."
- b. Pre-TAB meeting: Attend the meeting with the TAB Supervisor, and ensure that a representative is present for the sheetmetal contractor, mechanical contractor, electrical contractor, and automatic temperature controls contractor.
- c. INDVENT documentation: Furnish one complete set of the following INDVENT-related documentation to the TAB Agency:
  - (1) Contract drawings and specifications
  - (2) Approved submittal data for equipment
  - (3) Construction work schedule
  - (4) Up-to-date revisions and change orders for the previously listed items
- d. Submittal and work schedules: Ensure that the schedule for submittals and work required by this section and specified in paragraph entitled "TAB Submittal and Work Schedule," is met.
- e. Coordination of supporting personnel:

Provide the technical personnel, such as factory representatives or INDVENT controls installer required by the TAB field team to support the TAB field measurement work.

Provide equipment mechanics to operate INDVENT equipment and ductwork mechanics to provide the field designated test ports to enable TAB field team to accomplish the TAB field measurement work. Ensure these support personnel are present at the times required by the TAB team, and cause no delay in the TAB field work.

Conversely, ensure that the INDVENT controls installer has required support from the TAB team field leader to complete the controls check out.

- f. Deficiencies: Ensure that the TAB Agency supervisor submits all Design/Construction deficiency notifications directly to the Contracting officer within 3 days after the deficiency is encountered. Further, the Contractor shall ensure that all such notification submittals are complete with explanation, including documentation, detailing deficiencies.
- g. Prerequisite INDVENT work: Complete check out and debugging of INDVENT equipment, ducts, and controls prior to the TAB engineer arriving at the project site to begin the TAB work. Debugging includes searching for and eliminating malfunctioning elements in the INDVENT system installations, and verifying all adjustable devices are functioning as designed. Include as prerequisite work items, the deficiencies pointed out by the TAB team supervisor in the design review report.
- h. Prior to the TAB field team's arrival, ensure completion of the applicable inspections and work items listed in the TAB team supervisor's pre-field engineering report. Do not allow the TAB team to commence TAB field work until all of the following are completed.
  - (1) INDVENT system installations are fully complete.
  - (2) INDVENT prerequisite checkout work lists specified in the paragraph "Pre-Field TAB Engineering Report" have been completed, submitted, and approved. Ensure that the TAB Agency gets a copy of the approved prerequisite INDVENT work checklist.
  - (3) INDVENT system filters are clean for both Season 1 and Season 2 TAB field work.
- i. Advance notice: Furnish to the Contracting Officer with advance written notice for each event, the commencement of the TAB field work.
- j. Coordination With Insulation work: Ensure that openings in duct and machinery insulation coverings for TAB test ports are marked, closed and sealed.

#### 1.7.4.2 TAB Agency

Provide the services of a TAB team which complies with the requirements of paragraph entitled "TAB Personnel Qualification Requirements."

#### 1.7.4.3 TAB Team Supervisor

- a. Overall management: Supervise and manage the overall TAB team work effort, including preliminary and technical TAB procedures

and TAB team field work.

- b. Pre-TAB meeting: Attend meeting with Contractor.
- c. Design review report: Review project specifications and accompanying drawings to verify that the air systems are designed in such a way that the TAB engineer can accomplish the work in compliance with the requirements of this section. Verify the presence and location of permanently installed test ports and other devices needed, including manual volume dampers.
- d. Support required: Specify the technical support personnel required from the Contractor other than the TAB agency; such as factory representatives for temperature controls or for complex equipment. Inform the Contractor in writing of the support personnel needed and when they are needed. Furnish the notice as soon as the need is anticipated, either with the design review report, or the pre-field engineering report, or during the TAB field work.
- e. Pre-field engineering report: Utilizing the following INDVENT-related documentation; contract drawings and specifications, approved submittal data for equipment, up-to-date revisions and change orders; prepare this report.
- f. Prerequisite INDVENT work checklist: Ensure the Contractor gets a copy of this checklist at the same time as the pre-field engineering report is submitted.
- g. Technical Assistance for TAB Work: Provide immediate technical assistance to the TAB field team for the TAB work.
  - (1) TAB field visit: Near the end of the TAB field work effort, visit the contract site to inspect the INDVENT installation and the progress of the TAB field work. Conduct site visit full-time for a minimum of [one] [two] [\_\_\_\_\_] 8 hour workday[s] duration. Review the TAB final report data and certify the TAB final report.
- h. Certified TAB report: Certify the TAB report. This certification includes the following work:
  - (1) Review: Review the TAB field data report. From this field report, prepare the certified TAB report.
  - (2) Verification: Verify adherence, by the TAB field team, to the TAB plan prescribed by the pre-field engineering report and verify adherence to the procedures specified in this section.
- i. Design/Construction deficiencies: Within 3 working days after the TAB Agency has encountered any design or construction deficiencies, the TAB Supervisor shall submit written notification directly to the Contracting Officer, with a separate copy to the Contractor, of all such deficiencies. Provide in this submittal a complete explanation, including supporting documentation, detailing deficiencies. Where deficiencies are encountered that are believed to adversely impact successful completion of TAB, the TAB Agency shall issue notice and request direction in the notification submittal.

- j. TAB Field Check: The TAB team supervisor shall attend and supervise TAB field check.

#### 1.7.4.4 TAB Team Field Leader

- a. Field manager: Manage, in the field, the accomplishment of the work specified in Part 3, "Execution."
- b. Full time: Be present at the contract site when TAB field work is being performed by the TAB team; ensure day-to-day TAB team work accomplishments are in compliance with this section.
- c. Prerequisite INDVENT work: Do not bring the TAB team to the contract site until a copy of the prerequisite INDVENT Checklist, with all work items certified by the Contractor to be working as designed, reaches the office of the TAB Agency.

#### 1.7.5 Certified TAB Report

Submit certified reports in the specified format including the above data.

Include the reports specified in paragraphs entitled "Preliminary Review Report," "Smoke Test Reports," "Fan Operating Points Reports," "Static Pressure Report," "Volume and Velocity Flow Rates Report," and "Pitot Traverse Report" as appendices.

Submit field data and report forms in appendices separated by the fan system tested. Use the sample forms, "Replacement Air System Test Data" and "Exhaust Air System Test Data," to summarize the tests for the appropriate fan. Forms other than those listed may be used; however, include all information required by these forms.

Document deficiencies and unmet design requirements identified during testing. Notify the [Prime Contractor] [Contracting Officer] in writing, no later than [5] [\_\_\_\_] calendar days after encountering deficiency, describe the nature of the deficiency and a recommended course of action for resolution. Report daily temperature, humidity and barometric pressure readings. Note extreme weather and barometric pressure changes during the day.

- a. Report format: Submit the completed pre-field data forms approved in the pre-field TAB Engineering Report completed by TAB field team, reviewed and certified by the TAB supervisor. Bind the report with a waterproof front and back cover. Include a table of contents identifying by page number the location of each report. Report forms and report data shall be typewritten. Handwritten report forms or report data are not acceptable.
- b. System Diagrams: Provide a system diagram in the TAB report showing the location of all terminal outlet exhaust registers, and grilles. Use a key numbering system on the diagram which identifies each outlet contained in the outlet airflow report sheets.
- c. Smoke Tests Report: Describe turbulent air flow and dead air spaces in and around the hood capture zone. Describe air flow exiting from the replacement air distribution device and the effect of room air currents on smoke capture. Report leaks in the

ductwork, access door, and duct connectors to fan. Report smoke behavior as it exits from the exhaust stack and describe entrainment around the tested facility, nearby structures and any geographical features.

- d. Fan Operating Points Report: Determine the difference between measured and design volume flow rate. Compare measured fan static pressure to manufacturer's performance data. Show the design and measured operating point for each fan on the corresponding fan curve. Report fans that cannot operate at speeds 25 percent faster than the measured speed while remaining within the boundaries of the fan curve and fan class. Identify fan motors that are operating at or near full load amperage.
- e. Static Pressure Report: Furnish the following:
  - (1) Hood static pressures. Use tables to summarize test results by system.
  - (2) Fan static pressure, as defined by ACGIH 2090, for replacement and exhaust air systems.
  - (3) Room static pressure, as compared to [atmosphere] [adjacent rooms], for each room in the facility.
  - (4) Static pressures that are inconsistent and the probable reason. For example: inconsistent static pressure drop or increase in one or a series of hoods on the same branch; or different static pressures for similar systems in the facility; or decreasing static pressures as the hoods get closer to the exhaust fan inlet.
  - [(5) Differential pressure across air pollution control devices.]
- f. Volume and Velocity Flow Rates Report

Report volume flow rates and velocities in standard cubic meters per second (cms) and meter per second (m/s) cubic feet per minute (cfm) and feet per minute (fpm), respectively, on the "Exhaust Air System Test Data" sample form or comparable form.

[Convert measured volume flow rates to standard volume flow rates for locations with operating conditions other than standard temperature and pressure. The conversion may be ignored if the volume flow rate changes less than plus or minus one percent. Show both the actual and standard value for test points. Show a sample conversion equation.]

Compare [measured] [converted] volume flow rates with the design value for each hood, the total exhaust air system, each replacement air distribution point and the total replacement air system. List the [measured] [converted] and design values in tabular form. Report the transport velocity for each branch [submain] and main duct in the exhaust air system.

Indicate if the test value is adequate or inadequate. Adequate hood volume flow rates and duct velocities are those with [measured] [converted] values within plus or minus 10 percent of design values. Adequate total system volume flow rates are those with [measured] [converted] values within plus or minus 10 percent of the design values.

g. Pitot Traverse Report

Use the "Pitot Traverse Data" sample form or comparable form to record pitot traverse readings. Submit the following data, as a minimum, for each test location:

- (1) Velocity pressure and their corresponding velocities;
- (2) Average velocity;
- (3) Duct dimensions and area;
- (4) Total measured volume flow rate; and
- (5) Static pressure reading.

- h. Instruments: List the types of instruments actually used to measure the tab data. Include in the listing each instrument's unique identification number, calibration date, and calibration expiration date.

Instrumentation, used for taking wet bulb temperature readings shall provide accuracy of plus or minus 5 percent at the measured face velocities. Submit instrument manufacturer's literature to document instrument accuracy performance is in compliance with that specified.

- i. Certification: Include the typed name of the TAB supervisor and the dated signature of the TAB supervisor.
- j. Performance Curves: The TAB Supervisor shall include, in the Certified TAB Reports, factory fan curves for fans TAB'd on the job.

1.8 PRE/TAB MEETING

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**NOTE: Inclusion of this meeting requirement in the specification shall be based on the complexity of the INDVENT systems and the location of the contract site.**  
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Meet with the Contracting Officer's TAB representative [and the designing engineer of the INDVENT systems] to develop a mutual understanding relative to the details of the TAB work requirements. Ensure that the TAB supervisor is present at this meeting. Requirements to be discussed include required submittals, work schedule, and field quality control.

PART 2 PRODUCTS - NOT USED.

PART 3 EXECUTION

3.1 TAB PROCEDURES

3.1.1 TAB Field Work

Test, adjust, and balance the listed INDVENT systems to the state of operation indicated on and specified in the contract design documents.



Conduct TAB work, including maintenance and calibration of instruments, measurement accuracy, and sound measurement work in conformance with the AABC MN-1 and AABC TBP, or NEBB TABES, and NEBB MASV, except as supplemented and modified by this section. Provide instruments and consumables required to accomplish the TAB work.

Air systems shall be proportionately balanced and reported in the certified TAB report.

### 3.1.2 Preliminary Procedures

Use the approved pre-field engineering report as instructions and procedures for accomplishing TAB field work. Test ports required for testing by the TAB engineer shall be located in the field by the TAB engineer during TAB field work. It shall be the responsibility of the sheet metal contractor to provide and install test ports as required by the TAB engineer.

### 3.1.3 Test Method

Test the ventilation under full load conditions. Record quantitative readings on sample forms, "Pitot Traverse Data, [Rectangular Duct] [Round Duct]," "Exhaust Air System Test Data," and "Replacement Air System Test Data."

The TAB team is authorized to readjust and rebalance the system if minor adjustments will bring the system into compliance with the design. Minor adjustments include [adjusting the fan sheave] [correcting fan rotation] [resetting dampers] [adjusting blast gates] [\_\_\_\_\_].

#### 3.1.3.1 Smoke Test

Test each hood with smoke generators to verify contaminant control in the capture zone, prior to performing quantitative tests on the industrial ventilation system. Smoke simulates the contaminant. [Videotape the air movement pattern at the worker's breathing zone for the [hoods] [booths] [indoor firing range] [\_\_\_\_\_] [and air currents].] Comply with restrictions on the use of incendiary devices. Inform the fire department or other responsible parties when large quantities of smoke are expected [or the ventilation system has internal smoke alarms].

#### 3.1.3.2 Air Quantity Readings

\*\*\*\*\*

NOTE: Straight duct prior to the test point is essential to obtain a realistic average duct velocity. The velocity profile becomes distorted after disturbances such as elbows, contractions, expansions, branch entries in the exhaust system and heating coils in the replacement air system. Look at the drawings and determine if there is enough straight duct to obtain 7.5 duct diameters of straight airflow before the test points. If not, specify the exact test points more explicitly, e.g., 3 meters 10 feet from the positive pressure side of the fan, or between the fan and the scrubber. Do not use the terms upstream or downstream. In exhaust systems the total volume flow rate test point may be located before or after the fan or

**pollution control device. In replacement air systems  
the test point is placed after the fan.**

\*\*\*\*\*

Use a pitot tube and manometer to measure the velocity pressures for the exhaust and replacement air systems. Determine the number and location of velocity pressure readings required for round and rectangular ducts according to ACGIH 2090. Drill traverse access holes. [Round ducts require two traverse access holes positioned 90 degrees apart.] [Rectangular ducts may require several traverse access holes.]

Take pitot traverses away from air disturbing devices (i.e. elbows, branch entries, duct expansions, and hood transitions). Minimum distances are:

- a. Five (5) duct diameter of straight duct after the fan outlet; and
- b. Seven and one-half (7.5) duct diameters of straight duct after an air disturbing device.

When these distances of straight duct are not available, use a schematic drawing to note the disturbance producing device, and distance between the pitot traverse and the device.

Confirm one velocity pressure reading for each access hole after completing a traverse. Accept traverse data when the difference between the original and confirmation measurement is plus or minus 10 percent; otherwise repeat the traverse. Plug holes with cap plugs immediately after each traverse.

Convert velocity pressure readings to velocity before averaging the duct velocity. Calculate average velocity from velocity pressure readings and volume flow rates for the following locations:

- a. Replacement air fan outlet;
- b. Replacement air duct branch;
- c. Exhaust air duct branch, including hoods [and submains];
- d. Exhaust fan inlet or outlet;
- [e. Air pollution control device inlet; and]
- [f. Outside and return air ducts in recirculating replacement air system.]

#### 3.1.3.3 Air Velocity Meter Readings

A flow hood may be used for measuring office and restroom replacement air quantities. Do not substitute air velocity meter readings for manometer and pitot tube readings. Use air velocity meters to estimate the following:

- a. Velocity exiting from replacement air systems without ductwork;
- b. Crossdrafts in a room;
- c. Hood capture velocity;
- d. Duct velocities less than 3 m/s 600 fpm; and

[e. Slot velocities.]

#### 3.1.3.4 Static Pressure Readings

\*\*\*\*\*

NOTE: Static pressures are always required. If the system has no pollution control device, static pressure measurements are only required at the fan inlet and outlet. This is also true for the replacement air fans. To properly evaluate the system, differential pressures are needed across the fan and each air pollution control device. Look at each system and determine the appropriate test points.

\*\*\*\*\*

Take static pressure readings using a pitot tube and manometer. The following readings are required:

- a. Hood static pressure. Take readings at a distance of one duct diameter from tapered hoods, and 3 diameters from plain or flanged hoods;
- b. Replacement and exhaust fan inlet and outlet static pressure;
- c. Room static pressure as compared to [outdoors] [outside the area controlled by industrial ventilation];
- [d. Air cleaning device inlet and outlet static pressure; and]
- [e. Branch static pressure in the replacement and exhaust air system submain ductwork.]

Verify test instrument readings correspond with attached static pressure gages

#### 3.1.3.5 Control System Check-Out

Test warning system controls for the industrial ventilation system including the following:

- a. Above and below range alarms for room static pressure.
- b. Fan motor operating lights.
- [c. Dampers operated by the control motor.]
- [d. Hood static pressure.]
- [e. Dislodged or ripped filtration equipment.]
- [f. Overloaded air cleaning device.]

#### 3.1.3.6 Other Readings

Take the following readings on each day testing is performed:

- a. Temperature readings after the system has stabilized and has been running for at least 4 hours:

(1) Wet bulb and dry bulb temperature of ancillary rooms, workspaces, replacement air, outside air, [return air,] [and] [mixed air].

(2) External temperature for fan and motor bearings on ventilation equipment.

b. Record barometric pressure and altitude.

#### [3.1.4 Sound Measurement Work

##### 3.1.4.1 Areas To Be Sound Measured

In the following spaces, measure and record the sound power level for each octave band listed in ASHRAE HA Noise Criteria:

- a. All INDVENT mechanical rooms, including machinery spaces and other spaces containing INDVENT power drivers and power driven equipment.
- b. All spaces sharing a common barrier with each mechanical room, including rooms overhead, rooms on the other side of side walls, and rooms beneath the mechanical room floor.

\*\*\*\*\*

**NOTE: The designer/specifier shall select representative non-mechanical rooms which are occupied by any personnel and are served by each type of primary INDVENT air moving systems. Include rooms served by like primary systems which have significantly different sound affecting configurations. List, in the subparagraphs below, the rooms to be sound measured that will accomplish the aforementioned sound assessment philosophy. List the rooms by terminology identical to labeling indicated on drawings.**

\*\*\*\*\*

[c. INDVENT No. 1 System: Rooms: [\_\_\_\_]]

[d. [\_\_\_\_] System: Rooms: [\_\_\_\_]]

[e. [\_\_\_\_] System: Rooms: [\_\_\_\_]]

##### 3.1.4.2 Procedure

At the time the sound level is measured, each room shall be unoccupied, except for TAB team, and all INDVENT systems that would cause noise in the room shall be operating in their noisiest mode. Record the sound level (dB) in each octave band. Attempt to mitigate the sound level and bring the level to within the specified ASHRAE HA noise criteria goals, if such mitigation is within the TAB team's control. State in the report the ASHRAE HA noise criteria goals. If sound level cannot be brought into compliance, provide written notice of the deficiency to the Contractor for resolution or correction.

##### 3.1.4.3 Timing

Sound levels shall be measured at times prescribed by AABC or NEBB.

#### 3.1.4.4 Meters

Measure sound levels with a sound meter complying with ANSI S1.4 (ASA 47), Type 1 or 2, and an octave band filter set complying with ANSI S1.11 (ASA 65). Measurement methods for overall sound levels and for octave band sound levels shall be as prescribed by NEBB.

#### 3.1.4.5 Calibration

Sound levels shall be calibrated as prescribed by AABC or NEBB except that calibrators emitting a sound pressure level tone of 94 dB at 1000 hertz (Hz) are also acceptable.

#### 3.1.4.6 Background Noise Correction

Determine background noise component of room sound (noise) levels for each (of eight) octave bands as prescribed by AABC or NEBB.

#### 3.1.5 Workmanship

Conduct TAB work on specified INDVENT systems until measured parameters are within plus or minus 10 percent of the design values, that is, the values specified or indicated on the contract documents.

#### 3.1.6 Deficiencies

Strive to meet the intent of this section to maximize the performance of the equipment as designed and installed. However, if deficiencies in equipment design or installation prevent TAB work from being accomplished within the range of design values specified in the paragraph entitled "Workmanship," provide written notice as soon as possible to the Contractor and the Contracting Officer describing the deficiency and recommended correction.

Responsibility for correction of installation deficiencies is the Contractor's. If a deficiency is in equipment design, call the TAB team supervisor for technical assistance. Responsibility for reporting design deficiencies to Contractor is the TAB team supervisor's.

### 3.2 DATA FROM TAB FIELD WORK

After completion of the TAB work, prepare a pre-final TAB report using the reporting forms approved in the pre-field engineering report. Data required by those approved data report forms shall be furnished by the TAB team. Except as approved otherwise in writing by the Contracting Officer, the TAB work and the TAB report shall be considered incomplete until the TAB work is accomplished to within the accuracy range specified in the paragraph entitled "Workmanship" of this section.

Prepare the report neatly and legibly; the pre-final TAB report shall be the final TAB report minus the TAB supervisor's review and certification. Obtain, at the contract site, the TAB supervisor's review and certification of the TAB report.

Verbally notify the Contracting Officer's TAB representative that the field check of the certified TAB report data can commence; give this verbal notice 48 hours in advance of when the field checking shall commence. Do not schedule field check of the certified TAB report until the specified

workmanship requirements have been met or written approval of the deviations from the requirements have been received from the Contracting Officer.

### 3.3 QUALITY ASSURANCE FOR TAB FIELD WORK

#### 3.3.1 Field Check

Test shall be made to demonstrate that capacities and general performance of air systems comply with the contract requirements.

##### 3.3.1.1 Recheck

During field check, the Contractor shall recheck, in the presence of the Contracting Officer, random selections of data (air quantities, air motion, sound level readings) recorded in the certified report.

##### 3.3.1.2 Areas Of Recheck

Points and areas of recheck shall be selected by the Contracting Officer.

##### 3.3.1.3 Procedures

Measurement and test procedures shall be the same as approved for work for forming basis of the certified report.

##### 3.3.1.4 Recheck Selections

Selections for recheck will not exceed 25 percent of the total number of reported data entries tabulated in the report.

#### 3.3.2 Retests

If random tests reveals a measured quantity which is out-of-tolerance, the report is subject to disapproval at the Contracting Officers discretion. In the event the report is disapproved, all systems shall be readjusted and tested, new data recorded, new certified reports submitted, and a new field check conducted at no additional cost to the Government.

#### 3.3.3 Prerequisite for Approval

Compliance with the field checking requirements of this section is a prerequisite for the final approval of the certified TAB report submitted.

### 3.4 MARKING OF SETTINGS

Upon the final TAB work approval, permanently mark the settings of INDVENT adjustment devices including valves, splitters, and dampers so that adjustment can be restored if disturbed at any time. The permanent markings shall indicate the settings on the adjustment devices which result in the data reported on the submitted certified TAB report.

### 3.5 MARKING OF TEST PORTS

The TAB team shall permanently and legibly mark and identify the location points of the duct test ports. If the ducts have exterior insulation, these markings shall be made on the exterior side of the duct insulation. The location of test ports shall be shown on the as-built mechanical drawings with dimensions given where the test port is covered by exterior

insulation.

### 3.6 SAMPLE FORMS

SAMPLE FORM 15951-1

PITOT TRAVERSE DATA - Rectangular Duct

Page 1/2

Test Date \_\_\_\_\_

Readings By \_\_\_\_\_

Traverse By \_\_\_\_\_

Static Pressure \_\_\_\_\_

Room \_\_\_\_\_

Air Temperature \_\_\_\_\_

System/Unit \_\_\_\_\_

Barometric Pressure \_\_\_\_\_

Traverse Location \_\_\_\_\_

Inside/Outside Duct Width \_\_\_\_\_

Inside/Outside Duct Height \_\_\_\_\_

Inside Duct Area \_\_\_\_\_

Required Velocity \_\_\_\_\_

Required Actual Volume Flow Rate \_\_\_\_\_

Velocity Pressure Reported as \_\_\_\_ Units

Distance to Resistance Causing Component:

	Component	Distance
Before	_____	_____
After	_____	_____



SAMPLE FORM 15951-1

PITOT TRAVERSE DATA - Rectangular Duct

Page 2/2

Pitot Traverse Matrix

Velocity   Pressure Readings (minimum center distance is 150 mm Velocity   Pressure Readings (minimum center distance is 6 inches Point Position	<u>1</u>	<u>2</u>	<u>3</u>	<u>4</u>	<u>5</u>	<u>6</u>	<u>7</u>	<u>8</u>	<u>9</u>	<u>10</u>	<u>Confirm</u>
A	_____	_____	_____	_____	_____	_____	_____	_____	_____	_____	_____
B	_____	_____	_____	_____	_____	_____	_____	_____	_____	_____	_____
C	_____	_____	_____	_____	_____	_____	_____	_____	_____	_____	_____
D	_____	_____	_____	_____	_____	_____	_____	_____	_____	_____	_____
E	_____	_____	_____	_____	_____	_____	_____	_____	_____	_____	_____
F	_____	_____	_____	_____	_____	_____	_____	_____	_____	_____	_____
G	_____	_____	_____	_____	_____	_____	_____	_____	_____	_____	_____
H	_____	_____	_____	_____	_____	_____	_____	_____	_____	_____	_____

Velocity   Pressure Readings Converted to Velocity (m/s) (FPM) Point Position	<u>1</u>	<u>2</u>	<u>3</u>	<u>4</u>	<u>5</u>	<u>6</u>	<u>7</u>	<u>8</u>	<u>9</u>	<u>10</u>
A	_____	_____	_____	_____	_____	_____	_____	_____	_____	_____
B	_____	_____	_____	_____	_____	_____	_____	_____	_____	_____
C	_____	_____	_____	_____	_____	_____	_____	_____	_____	_____
D	_____	_____	_____	_____	_____	_____	_____	_____	_____	_____
E	_____	_____	_____	_____	_____	_____	_____	_____	_____	_____
F	_____	_____	_____	_____	_____	_____	_____	_____	_____	_____
G	_____	_____	_____	_____	_____	_____	_____	_____	_____	_____
H	_____	_____	_____	_____	_____	_____	_____	_____	_____	_____

Subtotal

Total Velocity/# Readings = Avg. Vel. x Duct Area = Actual Volume Flow Rate

\_\_\_\_\_ m/s / \_\_\_\_\_ = \_\_\_\_\_ m/s x \_\_\_\_\_ SQ. METER = \_\_\_\_\_ CMS  
 \_\_\_\_\_ FPM / \_\_\_\_\_ = \_\_\_\_\_ FPM x \_\_\_\_\_ SQ. FEET = \_\_\_\_\_ ACFM

ACFM =  
 ACFM =

SAMPLE FORM 15951-2

PITOT TRAVERSE DATA - Round Duct

Page 1/2

Test Date \_\_\_\_\_

Readings By \_\_\_\_\_

Traverse By \_\_\_\_\_

Static Pressure \_\_\_\_\_

Room Number \_\_\_\_\_

Air Temperature \_\_\_\_\_

System/Unit \_\_\_\_\_

Barometric Pressure \_\_\_\_\_

Traverse Location \_\_\_\_\_

Inside/Outside Duct Dia. \_\_\_\_\_

Inside Duct Area \_\_\_\_\_

Required Velocity \_\_\_\_\_

Required Actual Volume Flow Rate \_\_\_\_\_

Velocity Pressure Reported as \_\_\_\_\_ Units

Distance to Resistance Causing Component

	Component	Distance
before	_____	_____
after	_____	_____

SAMPLE FORM 15951-2

PITOT TRAVERSE DATA - Round Duct

Page 2/2

Pitot Traverse Matrix

Duct Diameter | 0-150 mm | 150-1219 mm | 1219 mm or unstable vel.  
 Readings | 12 (6/traverse) | 20 (10/traverse) | 40 (20/traverse)

TEST POINT	Velocity Pressure	Velocity	#	Velocity Pressure	Velocity
1	_____	_____	11	_____	_____
2	_____	_____	12	_____	_____
3	_____	_____	13	_____	_____
4	_____	_____	14	_____	_____
5	_____	_____	15	_____	_____
6	_____	_____	16	_____	_____
7	_____	_____	17	_____	_____
8	_____	_____	18	_____	_____
9	_____	_____	19	_____	_____
10	_____	_____	20	_____	_____

Confirm 1 \_\_\_\_\_

Confirm 1 \_\_\_\_\_

Confirm 2 \_\_\_\_\_

Confirm 2 \_\_\_\_\_

Velocity Sum \_\_\_\_\_  
 (Without Confirm Value)

Velocity Sum/# Readings = Average Velocity x Duct Area = Actual Volume Flow

Rate \_\_\_\_\_ m/s / \_\_\_\_\_ = \_\_\_\_\_ m/s x \_\_\_\_\_ SQ. METER = \_\_\_\_\_ CMS

SAMPLE FORM 15951-2

PITOT TRAVERSE DATA - Round Duct

Page 2/2

Pitot Traverse Matrix

Duct Diameter	0-6 in.	6-48 in.	48 in. or unstable vel.
Readings	12 (6/traverse)	20 (10/traverse)	40 (20/traverse)

TEST POINT	Velocity Pressure	Velocity	#	Velocity Pressure	Velocity
1			11		
2			12		
3			13		
4			14		
5			15		
6			16		
7			17		
8			18		
9			19		
10			20		

Confirm 1 \_\_\_\_\_

Confirm 1 \_\_\_\_\_

Confirm 2 \_\_\_\_\_

Confirm 2 \_\_\_\_\_

Velocity Sum \_\_\_\_\_

(Without Confirm Value)

Velocity Sum/# Readings = Average Vel. x Duct Area = Actual Volume Flow

Rate \_\_\_\_\_ FPM / \_\_\_\_\_ = \_\_\_\_\_ FPM x \_\_\_\_\_ SQ. Feet = \_\_\_\_\_ ACFM

SAMPLE FORM 15951-3

EXHAUST AIR SYSTEM TEST DATA

Test Dates \_\_\_\_\_

Readings By \_\_\_\_\_

Unit Number \_\_\_\_\_

Unit Location \_\_\_\_\_

Make Model \_\_\_\_\_

Model \_\_\_\_\_

Serial Number \_\_\_\_\_

Pressures (Pa)

Fan Inlet Static \_\_\_\_\_

Fan Outlet Static \_\_\_\_\_

Fan Inlet Velocity \_\_\_\_\_

Fan Static \_\_\_\_\_

Fan Total \_\_\_\_\_

Damper Positions

Hoods \_\_\_\_\_

Submains \_\_\_\_\_

Differential Pressure across  
air cleaning device

Device Delta P (Pa)

Total Volume Test Location

Duct dia. before fan \_\_\_\_\_

Duct dia. after fan \_\_\_\_\_

Fan Speed (RPM or RPS) \_\_\_\_\_

Motor Speed (RPM or RPS) \_\_\_\_\_

Resistance Causing Elements

Type                      Relationship to Fan  
                                 before/after    # Duct dia.

elbow                      \_\_\_\_\_

damper                      \_\_\_\_\_

expansion                      \_\_\_\_\_

contraction                      \_\_\_\_\_

plenum                      \_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

Pulley - Center to Center Distance

\_\_\_\_\_

Amperage - T1, T2, T3 \_\_\_\_\_

Voltage - T1-2, T2-3, T3-1 \_\_\_\_\_

Temperature (W.B./D.B.)

Outside Air \_\_\_\_\_

Replacement Air \_\_\_\_\_

RPM =

SAMPLE FORM 15951-3

EXHAUST AIR SYSTEM TEST DATA

Test Dates \_\_\_\_\_

Readings By \_\_\_\_\_

Unit Number \_\_\_\_\_

Pressures (inches of wg)

Unit Location \_\_\_\_\_

Fan Inlet Static \_\_\_\_\_

Make Model \_\_\_\_\_

Fan Outlet Static \_\_\_\_\_

Model \_\_\_\_\_

Fan Inlet Velocity \_\_\_\_\_

Serial Number \_\_\_\_\_

Fan Static \_\_\_\_\_

Fan Total \_\_\_\_\_

Damper Positions

Differential Pressure across  
air cleaning device

Hoods \_\_\_\_\_

Submains \_\_\_\_\_

Device                      Delta P (in. wg)

Total Volume Test Location

\_\_\_\_\_

Duct dia. before fan \_\_\_\_\_

\_\_\_\_\_

Duct dia. after fan \_\_\_\_\_

Fan Speed (RPM or RPS) \_\_\_\_\_

Motor Speed (RPM or RPS) \_\_\_\_\_

Resistance Causing Elements

Type                      Relationship to Fan  
                                 before/after   # Duct dia.

Pulley - Center to Center Distance

elbow                      \_\_\_\_\_

damper                      \_\_\_\_\_

expansion                      \_\_\_\_\_

Amperage - T1, T2, T3 \_\_\_\_\_

contraction                      \_\_\_\_\_

Voltage - T1-2, T2-3, T3-1 \_\_\_\_\_

plenum                      \_\_\_\_\_

\_\_\_\_\_

Temperature (W.B./D.B.)

\_\_\_\_\_

Outside Air \_\_\_\_\_

\_\_\_\_\_

Replacement Air \_\_\_\_\_

RPM =

SAMPLE FORM 15951-4

VOLUME FLOW RATES (Standard Cubic Meter per Second)  
VOLUME FLOW RATES (Standard Cubic Feet per Minute)

<u>SYSTEM</u>	<u>ACTUAL</u>	<u>DESIGN</u>	<u>ADEQUATE</u>	<u>INADEQUATE</u>
Total Volume	_____	_____	_____	_____
<u>SUBMAIN</u>				
Submain name_____	_____	_____	_____	_____
Submain name_____	_____	_____	_____	_____
Submain name_____	_____	_____	_____	_____
<u>HOODS</u>				
Hood name_____	_____	_____	_____	_____
Hood name_____	_____	_____	_____	_____
Hood name_____	_____	_____	_____	_____
Hood name_____	_____	_____	_____	_____
Hood name_____	_____	_____	_____	_____
Hood name_____	_____	_____	_____	_____
Hood name_____	_____	_____	_____	_____
Hood name_____	_____	_____	_____	_____
Hood name_____	_____	_____	_____	_____
Hood name_____	_____	_____	_____	_____

SAMPLE FORM 15951-5

REPLACEMENT AIR SYSTEM TEST DATA

Test Dates \_\_\_\_\_

Readings By \_\_\_\_\_

Unit Number \_\_\_\_\_

Unit Number \_\_\_\_\_

Unit Location \_\_\_\_\_

Make \_\_\_\_\_

Model \_\_\_\_\_

Serial Number \_\_\_\_\_

Pressures (Pa)

Pressures (inches of wg)

Fan Inlet Static \_\_\_\_\_

Fan Outlet Static \_\_\_\_\_

Fan Inlet Velocity \_\_\_\_\_

Fan Static \_\_\_\_\_

Fan Total \_\_\_\_\_

Damper Positions

Terminals \_\_\_\_\_

Submains \_\_\_\_\_

across Cooling Coil \_\_\_\_\_

across Preheat Coil \_\_\_\_\_

Differential Pressure

across Filters \_\_\_\_\_

across Reheat Coil \_\_\_\_\_

Total Volume Test Location

Duct dia. before fan \_\_\_\_\_

Duct dia. after fan \_\_\_\_\_

Fan Speed (RPM or RPS) \_\_\_\_\_

Motor Speed (RPM or RPS) \_\_\_\_\_

Resistance Causing Elements

Type

Relationship to Fan

before/after # Duct dia.

Pulley - Center to Center Distance

elbow \_\_\_\_\_

damper \_\_\_\_\_

expansion \_\_\_\_\_

contraction \_\_\_\_\_

plenum \_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

Amperage - T1, T2, T3 \_\_\_\_\_

Voltage - T1-2, T2-3, T3-1 \_\_\_\_\_

Temperature (W.B./D.B.)

Outside air \_\_\_\_\_

Replacement air \_\_\_\_\_

Mixed air \_\_\_\_\_

\* RPM - revolutions per minute  
RPS - radians per second

W.B. - wet bulb  
D.B. - dry bulb



SAMPLE FORM 15951-6

VOLUME FLOW RATES (Standard Cubic Meter per Second)  
VOLUME FLOW RATES (Standard Cubic Feet per Minute)

<u>SYSTEM</u>	<u>ACTUAL</u>	<u>DESIGN</u>	<u>ADEQUATE</u>	<u>INADEQUATE</u>
Total Volume	_____	_____	_____	_____
Outside Air Volume	_____	_____	_____	_____
Return Air	_____	_____	_____	_____
Ratio: Outside/Return	_____	_____	_____	_____
<u>BRANCH</u>				
Branch name_____	_____	_____	_____	_____
Branch name_____	_____	_____	_____	_____
Branch name_____	_____	_____	_____	_____
Branch name_____	_____	_____	_____	_____
Branch name_____	_____	_____	_____	_____
Branch name_____	_____	_____	_____	_____
Branch name_____	_____	_____	_____	_____

-- End of Section --